Today’s date is:
Imagine saying “Today’s date in the big 25 □□□

The Math *behind the*
European Gambling Roulette
- Why You Always Lose in the Long Run-

⚠Warning⚠
⚠ Before anything, this document was not made for educational purposes or a moral lesson, and it’s also not made to tell you what to do, like gamble or not, each person is free to do whatever they want, this is just a document to show the possible risks on this aspect ,and also advertise you, with all of this said, let’s begin ⚠

What is the European Gambling Roulette?

Well, the European Gambling Roulette is a roulette, like the name says, with numbers through zero to thirty-six, which eighteen of them are red, and eighteen of them are black, and the last number, the zero, which is green, and this number chances it all, there is also the American Roulette but uh, let’s just focus on the European one.

So, let’s suppose our roulette isn’t tricked or in favor of the casino, so, there are a lot of types, but, let’s just focus on four of these, at the end of the day, they all give the same result.

Gambling Styles:

- *A Number:* If you win, you get tridecusextuplicated (x36) your original money
- *A Color:* If you win, you get doubled (x2) your original money.
- *A Half:* Same as the color, if you win you get doubled (x2) your original money.

- *A Third:* If you win, you get tripled (x3) your original money.

Now here comes the math part:
The probability of winning by gambling on a color, is exactly:

$p=\frac{18}{37}=0.\overline{486}$Which is less than 50%, you may be saying: “Oh, but it’s too little, nothing is going to happen” Well, I’m sorry to tell you this, but it is, this is all because of the zero, that dang zero, that means that every eighteen of thirty-seven times you’ll win a coin, right? But Nineteen out of thirty-seven times you’ll lose a coin, this, represented on math, looks like:

$$E[X]=\frac{18}{37}\bullet 1+\frac{19}{37}\bullet(-1)=-0.0\overline{270}$$

By the way, this is also known as *Mathematical Hope E[X]*
Which is the expected result from a *random event,* in a more “elegant way”, it can be calculated with this formula:

Mathematical Hope:

$E[X]=\sum_{i=1}^{n} x_i \bullet P[X=x_i]$If E[X] = zero, that means that it’s a fair game, but if E[X]<zero, it's a game in favor of the casino/instution/building.
This negative mathematical hope, does not just happen to gambling by colors, but also in numbers, here, check it by yourself:

$E[X] = \frac{1}{37} \bullet 35 + \frac{36}{37} \bullet (-1) = -0.0\overline{270}$ And yes, it gets to the same result as before! Coincidence? Yes, because gambling is *NOT FAIR,* so if we keep gambling, we'll lose even more, exponentially losing all, why? Well, since we already said the mathematical hope is negative, gambling more and more gets to this result:

$$E[X_n] = -0.0\overline{270} \bullet n ¿ which\ n = Number\ of \times gambled.$$

So, at mathematical level, it's not convenient to keep gambling, you'll end up losing way too much. But, is there a way to win at the long run? Well, the answer is no (sadly) and it can be proved with a important property of the mathematical hope, in which it's a mathematical operator, for example, imagine you gambled at two machines individually, like you gamble for black (color) and red (color) for one of those, this is:

$$E[X_n + Y_n] = \left[\frac{18}{37}(1) + \frac{19}{37}(-1)\right] + \left[\frac{18}{37}(1) + \frac{19}{37}(-1)\right]$$

So, by this logic:

$$E[X_n + Y_n] = -0.0\overline{270} \bullet 2n$$

Which again, its negative, you'll end up losing even more if you try like this! but let's use a strategy known as the Martingale strategy, it goes like this

We have 7 coins, for example, ok? And we gamble 1, if we win, we win 1 coin, but if we lose, we gamble 2 coins, if we win, we win 1 coin again, but if we lose, we lose all.

This strategy, in mathematical terms or I don't know, I'm just saying mathematical terms because it sounds smarter, but it would look like:

$$We\ have\ D\ coins\ K = Number\ of \times played\ D = Coins$$

$$K_{end} = We\ cant\ gamble\ anymore\ 1 + 2 + 4 + \ldots 2^{k-1} = 2^k - 1 \leq D = ¿ K \leq \log_2(D+1)$$

So $K_{end} \approx \log_2(D+1)$ *So the probability of losing* $K \times ¿$ *a row is*:

$P[Lose\ K \times ¿\ a\ row] = \left(\frac{19}{37}\right)^k$ *Remember that its* $\frac{19}{39}$ *¿ the power*

its the number of $\times$ *we lost* $\in$ *a row. So the inverse event is*

$P[Win \in K \times ¿\ less] = 1 - \left(\frac{19}{37}\right)^k$ *Which lets aproximate with*

$1 - \left(\frac{1}{2}\right)^k \wedge$ *introduce* K_{end} *instead of k, so*:

$1 - \left(\frac{1}{2}\right)^{\log_2(D+1)} \wedge$ *with some simple calculations we get*: $1 - \left(\frac{1}{2}\right)^{lc}$

So if we had a infinite amount of money we could theoricall
win forever, but sadly we dont have infinite money.

Also, with this strategy we don't win that n
just end up winning one coin, which is not that much,
so let's say we use this strategy n times, so we get:

$P[Win\ after\ N\ martingales] \approx \left(1 - \frac{1}{D+1}\right)^n$

So as the number increases, let's use a table, to represent the values in a more visual way

N (Times played)	P (probability)
1	0.998(100)= 99.8%
10	0.980(100)= 98.02%
100	0.819(100)= 81.9%
200	0.670(100)= 67.05%
500	0.386(100)= 36.8%

And yeah, as you can see, the odds of *Quincentuplicating (x500)* your original money is about 36.8%, which is not that much, you'll end up at 0%, *or... Will you?*

As you can see, the probability is about 36.8%, *that's like one over Euler's number?* (0.3678) Is that a *coincidence?* No, it's not. But why?

So, as we said earlier our probability of winning after n martingales is about $\left(1-\frac{1}{D+1}\right)^{n}$

¿ that looks like the formula ¿ calculate euler's

Look: $e=\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^{n} \in$ which $N=D$ So with some simple equations we can go ¿

$$\left(1-\frac{1}{D+1}\right)^{n}=\left(1-\frac{1}{D+1}\right)^{D}=\left(\frac{D}{D+1}\right)^{D}=\left(\frac{1}{1+\frac{1}{D}}\right)^{D}=\left(1+\frac{1}{D}\right)^{-D}$$

Which if we add a limit we get: $\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^{-n}$ Which gets us $\frac{1}{e}$

So, at the end of the day, gambling is kind of a bad idea at the long run, but at the short run, you can maybe win sometimes, or lose sometimes, but this teaches us a lesson, and that is that "Bets are a reflection of our ability to take risks and face the consequences."

Sources: trust me bro □□

Also I didn't copy paste the info, idk the font just does this :/

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